

## MARKED UP VERSION

## **BACKGROUND OF THE INVENTION**

The application of various fluids to all or selected parts of the human body has been known literally for centuries. However, despite the long-standing and ~~wide-spread~~ widespread practice of coating the human body with various fluids, there has never been  
5 a successful way of automatically coating the human body. Therefore, prior to the present invention, it has been necessary to apply fluids to the body manually.

Manual application of fluids to the human body results in numerous disadvantages. First, it is almost impossible to uniformly coat the human body with fluids using manual application techniques. This is true even in the case of fluids that are provided in  
10 aerosol or spray form because such fluids must be rubbed in after application. Second, the application of fluids to certain parts of the human body, for example, the back, require the availability of an assistant in order that proper manual application can be attempted.

The foregoing difficulties are particularly apparent in the case of artificial tanning  
15 processes, hereinafter sometimes referred to as self-tanning or sunless tanning compositions and systems. Artificial tanning has been known for more than 40 years, with artificial tanning products appearing on the U.S. market as early as 1959. The two key types of tanning processes are by colorants and bronzers.

preservatives,

- ~~antimicrobials~~ anti-microbial,
- thickeners,
- solvents,
- 5 ● emulsifiers,
- fragrances,
- surfactants,
- stabilizers,
- ~~sun-screens~~ sunscreens,
- 10 ● pH adjusters,
- anti-caking agents,
- ingredients to alter the color reaction.

Users of these products often experience significant problems associated with the current methods for applying artificial tanning formations to skin. These problems include the following.

- If not properly dried, the formulation will streak or form blotches with time. The net result is a very ~~non-uniform~~ nonuniform tan, with light or dark streaks or blotches.
- Certain parts of the body will stain more intensely when the formulation is spread manually. This differential staining is due to ~~enhance~~ enhanced absorption of certain skin tissue and the tendency of certain tissue to retain more

- insect repellants,
- skin toners,
- skin bleaches,
- skin lighteners,
- 5 ● anti-microbial compositions,
- moisturizers,
- exfoliants,
- nutriments or vitamins,
- massage ~~aides~~ aids,
- 10 ● muscle relaxants,
- skin treatment agents,
- burn treatment agents,
- decontamination agents,
- cosmetics,
- 15 ● wrinkle treatments or removers.

There are specific and significant problems with the manual coating of each of these products. The artificial tanning application provides a good illustration of the types of problems normally encountered when manually coating these products. Artificial tanning is also one of the most demanding applications in that uniformity of the coating

20 is critical to assure uniform tanning.

## **SUMMARY OF THE INVENTION**

The present invention comprises a system for automatically coating the human body, including a method of and apparatus for uniformly and rapidly coating all or selected parts of the human body. The system includes apparatus which atomizes (also referred to as aerosolization, nebulization, mist generation, fog generation or spray generation) a chemical composition and deposits it uniformly over all or selected parts of the human body. It is not necessary for the individual receiving the treatment nor anyone else to manually apply any of the formulation. Also, a containment system is provided which restrains and collects residue from the application process. The system can optionally recycle the materials used.

There are several major advantages resulting from the use of the invention:

- Uniform application minimizes or eliminates streaking,
- No assistant is required for applying the composition,
- The entire skin surface receives the same exposure to the composition, so the ~~uniformly~~ uniformity of the coating is greatly enhanced over manual application,
- The optimal formulation for atomization is very simple, and does not require the addition of components which may inhibit the efficacy of the applied material,
- The application time can be as quick as a few seconds, and complete drying can occur in just a few minutes,

The containment system drastically reduces the unwanted environmental impact,

- Multiple applications can be used to better control the amount of material applied per unit area, and additional substances can be applied in separate applications.

5

The invention may be practiced utilizing a unitary construction including both a coating chamber and apparatus for coating a person situated within the coating chamber. A door provides ingress to and egress from the coating chamber which is provided with vertically disposed arrays of spray discharging nozzles situated at spaced apart points around the periphery of the chamber. A blower circulates air through the coating chamber to effect drying following the coating procedure and to aid in containment of excess spray. An air compressor supplies liquid for coating and compressed air for spraying the coating liquid to the nozzles situated within the coating chamber.

10

15 In accordance with another aspect of the invention, there is provided a plural component system for coating the human body. The plural component system may comprise a single discharge nozzle which simultaneously or sequentially receives fluid from separate sources. Alternatively, the plural component system may comprise two or more discharge nozzles each receiving fluid from a separate source. Both techniques keep various components of the composition to be applied ~~to the~~ to the skin entirely separate until the moment of application.

20

The present invention further comprises an improved self-tanning composition. The improved self-tanning composition is particularly adapted for use in conjunction with the method and apparatus hereof.

**DETAILED DESCRIPTION OF THE INVENTION**

Referring now to the Drawings, and particularly to **Figure 1**, the system for automatically coating the human body of the present invention may comprise an automated coating system for numerous types of formulations, including but not limited to the application of:

- self-tanning formulations,
- sunscreens,
- suntan lotions,
- tanning accelerators,
- 10 ● ~~sub-burn~~ sunburn treatments,
- insect repellants,
- skin toners,
- skin bleaches,
- skin lighteners,
- 15 ● anti-microbial compositions,
- moisturizers,
- exfoliants,
- nutriments or vitamins,
- massage ~~aides~~ aids,
- 20 ● muscle relaxants,
- skin treatment agents,
- burn treatment agents,
- decontamination agents,



decontamination agents,

- cosmetics,
- wrinkle treatments or removers.

5 The first component of such a system is the chemical composition. The suitability of  
a composition for coating is strongly influenced by its viscosity, with the preferred  
viscosity being close to that of water (1 centipoise). Compositions with viscosities in  
the 1 to 10 centipoise range generally atomize well, and viscosities in the 10 to 100  
range can be atomized, but the resulting spray is not as fine. Higher viscosities can be  
atomized, and will work, but the spray is not as fine. Most currently marketed  
10 compositions of the aforementioned applications can be made suitable for atomization  
either as is or with appropriate dilution.

By way of example, a more detailed description of functional compositions for use in  
practice of the invention will be based on artificial tanning compositions. Six such  
compositions are given in Compositions 1, 2, 3, 4, 5, and 6. Individuals skilled in this  
15 art can create other compositions.

#### COMPOSITION 1

<u>Ingredient</u>	<u>%</u>
Dihydroxyacetone	3.0
20 Water	97.0

	Citric acid	0.3
	Commercial bath product	0.6
	Bronzer	6.0
5	Water	64.1

By way of example, a suitable commercial moisturizer would include Vaseline Brand Intensive Care Aloe and Naturals lotion (Chesebrough-Ponds, Greenwich, CT), and a suitable commercial bath product would include Vaseline Brand Intensive Care Foaming Creme Bath (Chesebrough-Ponds, Greenwich, CT). The bronzer is a combination of  
10 FD&C dyes that yield a golden brown color.

#### **COMPOSITION 6**

	<u>Ingredient</u>	<u>%</u>
	Bronzer	8.0
	Commercial moisturizer	20.0
15	Commercial bath product	0.6
	Ethoxydiglycol	2.0
	Water	69.4

By way of example, a suitable commercial moisturizer would include Vaseline Brand Intensive Care ~~aloe~~ Aloe and Naturals lotion (Chesebrough-Ponds, Greenwich, CT), and  
20 a suitable commercial bath product would include Vaseline Brand Intensive Care Foaming Creme Bath (Chesebrough-Ponds, Greenwich, CT). The bronzer is a combination of FD&C dyes that yield a golden brown color.

human skin. Similar dilutions of products representing the other aforementioned applications can be effectively atomized and coated on human skin.

There is no pH adjustment required for these compositions, although the pH can be adjusted to alter the hue of the resulting tan and to alter the dihydroxyacetone stability.

- 5 The optimal tanning occurs with DHA at a pH of below 6.0, preferably with the solution at a pH 3.0 to 4.0. Unbuffered DHA has a pH of about 5.5. The pH on the surface of human skin is also about 5.5. Nonetheless, these formulations can be used over a wide pH range, and buffers or pH adjusters can be added.

A preferred colorant is DHA. DHA is available from Rona (Hawthorne, New York).

- 10 It is effective, safe, and approved by the FDA for this application. The preferred DHA concentration is 0.5% to 20%, with a more preferred range of ~~3.0%~~ 3% to ~~15.0%~~ 15%, and a most preferred range of 5% to 12%.

Numerous other colorants can also be used. Those agents include, but are not limited to:

- 15
- crotonaldehyde
  - pyruvaldehyde
  - glycolaldehyde
  - glutaraldehyde
  - ortho-phthaldehyde
- 20 sorbose

Alcohol can be added to the composition to accelerate the rate of drying. Denatured ethanol (USP grade, commodity chemical) works well in this capacity. The preferred range for alcohol concentration is from 1.0% to 50.0%, with a more preferred range from 10.0% to 30.0%, and a most preferred concentration of 20.0%.

5 Other potential additives include:

- moisturizers,
- preservatives,
- ~~antimicrobials~~ anti-microbials,
- thickeners,
- 10 ● solvents,
- emulsifiers,
- fragrances,
- stabilizers,
- ~~sun-screens~~ sunscreens,
- 15 ● surfactants,
- pH adjusters,
- anti-caking agents,
- ingredients to alter the color reaction.

It typically requires about 100 ml of a 5.0% DHA composition to obtain a medium to  
20 dark tan over an entire adult body (about 2 square meters of skin). A single application of about 250 ml of a 9% dihydroxyacetone composition over an entire adult human body will result in a very dark tan. The exact amount of dihydroxyacetone required depends

heated charged particles

high speed rotational atomizers

- ultrasonic

5 These forms of atomization are the basis for most methods of producing atomized sprays, including misting and nebulization.

Using a single airless sprayer with a tip orifice of 0.6 mm, with a circular spray pattern of 12 inches at 12 inches from the tip, and with a flow rate of approximately 400 ml/min. the entire body (excluding the bottom of the feet) of an average-sized person can be coated with solution in 5 to 15 seconds. In practice, the underside of the feet  
10 usually ~~get~~ gets slightly tanned also from exposure to small quantities of residual artificial tanning composition on the floor of the application area. The use of a single airless sprayer to apply a composition to human skin is illustrated in **Figure 2**. In this figure and subsequent figures, 11 designates the orifice for atomization of the composition, 12 designates the atomized spray, and 13 designates the subject being  
15 sprayed. In this configuration, an operator must direct the flow of the spray. The configuration illustrated in **Figure 2** would also work for any of the other atomization methods aforementioned, and for any of the applications aforementioned. The preferred atomization method is the pressure-free air-atomization system, with an internal or external atomization configuration.

20 For a person to be coated as illustrated in **Figure 2** with an artificial tanning composition (or any composition of the applications aforementioned), several precautions should be

avoiding spray getting onto and staining items in the immediate surroundings,

- facilitating capture and recovery processes,
- better control of air flow,
- 5      ● better control of temperature and humidity.

This type of containment facilitates the use of this invention in enclosed areas such as stores or medical facilities.

Control of air and spray flow is very important to the quality of the skin coating. It is highly preferable to have an exhaust fan drawing the spray towards the person being coated, and the residual composition out of the booth. In **Figure 4** is shown the addition  
10 of an exhaust fan 18. The fan offers several significant advantages to the invention. These advantages include but are not limited to:

- better control of air flow
- shorter exposure to residue spray, requiring less time to hold breath or  
15 breathe through filter or air line
- faster drying of the coated composition on skin
- better quality coating

The fan 18 should have a flow of 10 to 5000 cubic feet per minute per square foot of opening, preferably 50 to 1000 cubic feet per minute per square foot, and most  
20 preferably 100 to 400 cubic feet per minute per square foot. At flow rates of below 100 cubic feet per minute per square foot, the air movement is sufficient to guide the

atomized spray results in an area of intense atomized solution, which would coat an individual standing in that area. The residual spray would then be dissipated into the surrounding environment. A fan could be used to accelerate the removal of the residuals from the coating area.

5       **Figure 8** illustrates how the system of the present invention can be used to tan a selected part of the body. In this case, just the face is being tanned. In this figure the bottom panel of the apparatus 22 contains an opening through which one can insert his or her head. The top panel 23 is arched. The high-efficiency filter is 19. The fan and back panel is 15 18. Alternately, the setup as shown in **Figures 2-7** could be used to tan only a select part of the body by protecting the area not desired to be tanned with appropriate barrier apparel or by screens between the atomized spray and the regions of the skin not to be coated. The barrier apparel could be any material impervious to the atomized coating composition. For example, materials appropriate for use with the  
10       aforementioned coating compositions include vinyl, polyurethane, and latex rubber. The screens can be sheets composed of any material impervious to the atomized artificial  
15       tanning compositions, including most metals or plastics. A preferred screening material is foam with an impervious aluminum foil backing. The foam is aligned with the backing away from the atomizing orifice. The foam is preferred because it absorbs much of the atomized spray, reducing back deflection.

20       **Figures 9, 10, 11, and 12** illustrate an apparatus which may be utilized in the practice of the invention. The apparatus 30 comprises a unitary construction which includes both a coating chamber 32 adapted to receive a person to be coated with a

includes both a coating chamber 32 adapted to receive a person to be coated with a predetermined substance and various components utilized to effect spraying of the predetermined substance onto the person situated within the coating chamber 32.

5 The coating chamber 32 includes a door 34 which affords ingress to and egress from the coating chamber. The coating chamber 32 is further provided with a plurality of spray columns 32 36. As is best shown in **Figure 10**, the spray columns 36 are located at spaced apart points around the periphery of the chamber 32. Those skilled in the art will appreciate the fact that neither the number nor the precise location of the spray columns 36 is critical to the practice of the invention, and that other spray column  
10 arrangements may be utilized in the practice of the invention, if desired.

The spray columns 36 are preferably supported for pivotal movement through predetermined arcs under the action of a pneumatic cylinder 38. In this manner the predetermined material is discharged from the spray columns 36 in such a way as to assure uniform coating of the predetermined material on a person situated within the  
15 spray coating chamber 32. The pneumatic cylinder 38 is connected to the pivoting mechanism of each of the spray columns 36 through a plurality of links 40.

Referring again to **Figure 9**, there is further ~~includes~~ included a blower 46 which directs a flow of air upwardly along an air guide 48 and then laterally along a top panel 50 into engagement with a plurality of baffles 52. The baffles 52 direct the air from the  
20 blower 46 downwardly through the coating chamber 32, whereby the flowing air effects drying of the sprayed material and aids in recovery of the sprayed material for reuse. From the coating chamber 32 the air is directed through a plurality of filters 54 and is returned to the blower 46.



coating chamber 32 the air is directed through a plurality of filters 54 and is returned to the blower 46.

The predetermined material which is to be coated onto a person situated within the coating chamber 32 is preferably provided in the form of a liquid which is received in a reservoir 60. The interior of the reservoir 60 is pressurized by compressed air which is received from an air compressor 62 through an air tank 64. Compressed air from the air compressor 62 in the tank 64 is also directed to an air tank 66 and to a manifold 68. The air tank 66 provides compressed air for operating the pneumatic cylinder (Figure 10). The manifold 68 directs compressed air to the spray columns 36.

Ideally, all of the liquid from the reservoir 60 which is discharged from the spray columns 36 would be received on the body of the person within the coating chamber 32. In actual practice, it is not possible to obtain 100% efficiency in the coating procedure. Excess liquid which is discharged from the spray columns moves downwardly under the action of gravity onto a drain ramp 72. A drain pump 74 receives the excess liquid through a suction pipe 76 and delivers it to an appropriate drain.

Referring to Figures 11 and 12, each spray column 36 includes an inner tubular passageway 84 which receives liquid from the reservoir 60 under the action of compressed air supplied by the air compressor 62 through the tank 64 and an outer tubular passageway 86 which receives compressed air from the manifold 68. Each spray column 36 is provided with a plurality of nozzles 88. Each nozzle 88 receives compressed air from the outer tubular passageway 86 through a quick disconnect 90 and receives liquid from the inner tubular passageway 84 through a quick disconnect 92. A check valve 94 prevents reverse flow of liquid back through the quick disconnect 92.

receives liquid from the inner tubular passageway 84 through a quick disconnect 92. A check valve 94 prevents reverse flow of liquid back through the quick disconnect 92.

**Features Contributing Significantly to the Successful  
Operation of an Automated Coating System for  
the Human Body Incorporating the Invention**

Formula:

The following formula is a combination of water, dihydroxyacetone, bronzer, moisturizer, surfactant, and penetration enhancer. The formula is:

			<u>Range</u>	<u>Preferred</u>
10	water	base	16%-65%	41.7%
	dihydroxyacetone	self-tanning	3% - 15%	10.0%
	bronzer*	cosmetic colorant	0% - 10%	8.0%
	ethoxy diglycol	penetration enhancer	0% - 10%	5.0%
	commercial			
15	moisturizer lotion**	film former, viscosity	10% - 25%	15.0%
	commercial bath			
	product***	surfactant	0% - 2%	0.6%
	citric acid	pH adjustment	0.1% - 1.0%	0.2%
	10x aloe vera concentrate	moisturizer, tan	1% - 5%	2.5%
20		enhancer		
	isopropyl alcohol with	solvent,	5% - 25%	15.0%
	methyl salicylate	penetration enhancer		
	Trivosol®	emulsifier	.5% - 10%	2.0%

\* By way of example, a suitable bronzer would be a combination of the following food dyes provided by Adams Extract Company, Austin, Texas: 4 parts red, 2 parts yellow, 1 part green, and 3 parts purple.

\*\* By way of example, a suitable commercial moisturizer lotion includes Vaseline Intensive Care Lotion (Aloe Vera Triple Action Formula, Chesebrough-Ponds, Greenwich, CT).

\*\*\* By way of example, a suitable commercial bath product includes Vaseline Intensive Care Foaming Crème Bath (Chesebrough-Ponds, Greenwich, CT).

#### Foot Shields:

5                   The feet are one of the most difficult parts of the body to coat uniformly. This difficulty is due in large part to the irregular structure of feet. Also, the downward motion of the atomized mist, both by gravity and from air currents, tends to cause the mist to settle on the tops of the feet. Therefore, the feet are provided with shields to assure a more uniform coating of the feet. The shields may take the form of a large, bottomless shoe. The shields produce a silhouette effect from the top of the feet to the toes. Holes and openings are provided in the shields which are located .25 to 2 inches from the feet, allowing the mist to result in a silhouette effect rather ~~that~~ than defined lines.

10

#### Air Shield to Deflect Air Away From the Feet:

15                   To reduce the amount of mist settling on the feet, a plastic shield shaped like a figure 8 eight is placed between the fleximat flooring the user stands on and the metal grating supporting the fleximat. Dimensions of the figure eight are two 18 inch diameter overlapping circles with a total width of 26 inches. The total width can vary from 18 inches to 36 inches, and the circle diameters can vary from 12 inches to 20 inches.

#### Toweling Buffing After Coating:

20                   After coating it is advantageous to use a towel rub to buff over the entire body to yield a more uniform coating and to remove any areas of excess. The toweling yields a more cosmetically pleasing result and reduces transfer to clothing. It is preferred to towel using long, light strokes. A cotton bath towel 16 inches by 32 inches may be used. The towel could vary from a hand cloth (8"x8") to a large beach towel (18"x48"). Care must be taken not to rub so hard or too much as to rub off the coating (or tan). Basically, the weight of the preferred towel is adequate, without additional pressure.

25

#### Stance During Coating:

30                   The stance ~~using~~ used during the coating is important. After trial and evaluation of numerous methods, it has been discovered that the "ballerina stance" seems to work best. Key elements of the stance are:

- hands over the head
  - preferred 2 inches
  - lower limit – hands touching head
  - upper limit – arms extended fully up
- 35                   hands parallel to the floor
  - hands could be, but not recommended to be, perpendicular to floor in a praying stance, or facing downwardly
  - feet separated about 12 inches

feet separated about 12 inches  
to allow mist to coat inside of legs  
feet are flat on flooring  
use of feet shields as described above

5 Hair Net:

Although the above-described self-tanning solution does not turn hair orange, it may accumulate on hair. To avoid this accumulation, the user can wear a hair net or bouffant. Preferred compositions for the hair net include a cloth or plastic mesh or a ~~continuous~~ continuous plastic sheet.

10

Barrier Cream:

It has been discovered that the commercial barrier cream produced by GoJo blocks the tanning solution from the skin. During the coating process, this lotion can be used to prevent tanning of specific areas, such as the palms of the hands.

15

High Efficiency Filter:

The use of high efficiency filters to remove excess mist is important. Preferably, a Binks high-efficiency paint-pockets filter is used.

20

Recharging of Filter:

It has been discovered that the tanning solution trapped in the filter can be removed with a water rinse. The solution, which is water soluble, is flushed out using water that is back-washed (water applied to the top surface opposite of the surface facing the solution) or water, preferably under moderate (greater than 60 psi) pressure, that is hosed on the filtered surface.

25

Uniform Air Flow:

30

Uniformity of air flow is very important to assure that the mist continues to be applied uniformly over the body even after the pressurized spray stops. Air flow parameters are, in the downward motion:

35	most preferred	100 cfm
	next preferred	50 cfm to 200 cfm
	next preferred	25 cfm to 300 cfm

### Warming of Air:

5 Atomization of liquids as done here by the nozzles results in a significant reduction in liquid temperature (as much as 20°F). To keep the temperature to a warm, pleasant experience, four halogen lamps (250 watts each) can be added to the system to provide both illumination and heat. A coating chamber temperature of 80 °F to 110 °F is preferred, with 90 °F to 100 °F being more preferred. Other heating devices include infrared lamps and electrical heating elements.

### 10 Examples

#### Example 1

15 A twenty year old female of type III skin tanned by this process. She first applied a heart shaped sticker on her right arm. She covered her hair with a nylon mesh hair net and applied barrier cream over the palms of her hands. She tanned in the coating chamber. The ~~formula~~ subject above was coated for 7 seconds. About 300 grams of solution was applied during such time. There was a subsequent 7 second period in which the mist was circulated in the booth. The residual mist was removed from the booth and the subject dried for about 45 seconds. The subject then removed any excess lotion with a towel. The final result was that the subject was 1 to 2 shades darker after tanning. This difference was especially apparent when comparing the area under the sticker with the area with no sticker. The initial color was mainly from the bronzer, and is a deep brown color. Color was much more intense the next day, when the color was at least two shades darker than before tanning. After the subject 25 showered, the intensity was dropped to about 1 shade darker than prior to tanning. This color, which was mainly from the dihydroxyacetone, was golden-brown. The color persisted about 1 shade darker for 3-4 days, and noticeable color was present for 7 days.

#### Example 2

30 A forty-seven year old male with type II skin tanned by this process. He first applied a heart shaped sticker on his right arm. He covered his hair with a nylon mesh hair net and applied barrier cream over the palms of his hands and the bottoms of his feet. He tanned in the coating chamber. The ~~formula~~ subject above was coated for 7 seconds. About 300 grams of solution was applied 35 during time. There was a subsequent 7 second period in which the mist was circulated in the booth. The residual mist was removed from the booth and the subject dried for about 45 seconds. The subject then removed any excess lotion with a towel. The final result was that the subject was about 1 shade darker after tanning. This difference was especially apparent when comparing the area under the sticker with the area with no sticker. The initial color was mainly from the 40

5 with the area with no sticker. The initial color was mainly from the bronzer, and is a deep brown color. Color was much more intense the next day, when the color was one to two shades darker than before tanning. After the subject showered, the intensity was dropped to about 1 shade darker than prior to tanning. This color, which was mainly from the dihydroxyacetone, was golden-brown. The subject repeated the tanning process again later the second day. This time, the initial tan from the combination of previous tan and new bronzer was about 2 shades darker than before. Even after showering the next day, the tan was about two shades darker than prior to initially tanning. The color persisted about 2 ~~shade~~ shades darker for 3-4 days, and noticeable color was present for 10 days.

### Example 3

15 A 24 year old female with type II skin tanned as described in examples 1 and 2 for five consecutive days. The results were a highly uniform, very dark tan. Her skin color was about 3 shades darker by the end of the week. The color was golden-brown. The color remained 2 to 3 shades darker for about 4 days, and some color (about 1 shade) was observed after 7 days.

### Discoveries

#### Very Fast Drying:

20 Traditional sunless tanning products require 20 minutes or more to dry. The sunless tanning composition of the present invention dries within a minute after use.

#### Less Transfer to Clothing Than Expected:

25 Traditional sunless tanning products do not contain bronzers because bronzers transfer to clothing and other fabrics. The present invention exhibits almost no such transfer.

#### Tan Hue Less Orange Than Expected:

The combination of ~~bronzes~~ bronzers, tan enhancers, and a super application process produces a long lasting, golden-brown color.

Hair is Not Turned Orange:

5 Self-tanning lotions have been reported to turn body hair orange. The formulation and application of the present invention do not cause the hair to turn orange. First, the formulation does not penetrate the hair, but rather beads up on it. Next, it is applied in a very thin coat. The net result is that the hair does not turn orange.

Produces a Very Uniform Tan:

10 The present invention facilitates the application of a thin, uniform film over the entire body. Consequently, the resulting coating and tan is far superior to manual application methods.

Bronzer Tends to Last Longer Than Expected:

15 The bronzer provides immediate color and a method for observing the uniformity of the tan. The uniformity of the bronzer application is greatly ~~enhance~~ enhanced because it is applied in a uniform, thin film and its substantivity is enhanced because of deeper penetration into skin with the presence of a penetration enhancer.

Use of Ethoxy Diglycol as a Penetration Enhancer Makes the Tan Last Longer and More Uniform:

20 With the use of ethoxy diglycol, the duration of uniform intense tan has ~~increase~~ increased from an average of about 2 days to an average of about 4 days, and some color persists for up to 14 days.

The foregoing improved self-tanning composition is advantageously utilized in conjunction with the method and apparatus of the present invention.

**Plural Component Systems**

25 As is well known by those skilled in the art, the vast majority of cosmetics are single component systems. Examples include traditional creams, lotions, or sprays.

Plural component systems are a rare exception. Although many of cosmetic products would perform better as plural component systems, the consumer market generally does not like or cannot deal with multiple component systems. Even professionals, such as beauticians, generally prefer single component systems.

- 5 Even medical or industrial products are generally single component. Again, the end users do not like dealing with multiple component systems.

In some cases, these objections are circumvented by unique delivery systems with which automatically mix the components. One example of such a system is the dual syringe delivery apparatus used with two part epoxy systems. Another example comprises spray  
10 devices for applying paints and coatings using plural nozzle heads.

Referring to Figure 13, there is shown a plural component spraying system 100 of the type conventionally utilized in applying paints and coatings. The spray system 100 includes a spray gun 102 having a single nozzle 104. The spray gun 102 receives compressed air through a line 106. A first component of a composition to be applied is  
15 received through a line 108 and a second component of the composition ~~as~~ is received through a line 110. The two components are mixed in the nozzle 104 and discharged therefrom as a unitary composition.

Referring to Figure 14, there is shown a plural component spraying system 120 of the type conventionally utilized in the application of paints and coatings. The plural



Referring to Figure 14, there is shown a plural component spraying system 120 of the type conventionally utilized in the application of paints and coatings. The plural component spraying system 120 includes a spray gun 122 having a dual discharge nozzles 124 and 126. A first component of a composition to be applied is received by  
5 the nozzle 124 through a line 128. A second component of the composition to be applied is received by the nozzle 126 through a line 130. Compressed air is directed to the spray gun 122 through a line 132.

In the operation of the plural component spraying system 120, the component parts of the composition to be applied are not mixed in the nozzles 124 and 126. Rather, the  
10 nozzles 124 and 126 each discharge a separate and distinct component of the ultimate composition to be applied. Mixing of the two components to form the ultimate composition occurs as the components which are discharged from the nozzles 124 and 126 simultaneously engage the surface to be coated.

Figure 15 illustrates an adaptation of the apparatus illustrated in Figures 9, 10, 11, and  
15 12 and described hereinabove in connection therewith whereby the apparatus is adapted for plural component spraying.

A nozzle 140 receives fluid from two passageways 142 and 144. Remotely operated valves 146 and 148 are utilized to control the flow of fluid from the passageways 142 and 144, respectively, to the nozzle 140.

The fluids received by the nozzle 140 from the ~~lines~~ passageways 142 and 144 through the remotely operated valves 146 and 148, respectively, may comprise the components of a plural component system to be applied, for example, to the human body. Alternatively, the ~~lines~~ passageways 142 and 144 may be utilized to supply entirely  
5 separate fluids which are applied sequentially. For example, a skin preconditioner could be supplied through the ~~line~~ passageway 142 and discharged from the nozzle 140 for application to the skin of the person to be tanned, allowed to remain in contact with the skin of the person to be tanned for a predetermined period of time, and thereafter removed from the skin by towel rubbing prior to the application of a self-tanning  
10 composition which is received by the nozzle 140 through the ~~line~~ passageway 144 and discharged by the nozzle onto the skin of the person to be tanned.

Those skilled in the art will appreciate the fact that the apparatus illustrated in Figure 15 is not limited to receiving the discharging two fluids. Rather, multiple lines can be connected to the nozzle through multiple remotely operated or valve components  
15 thereby facilitating the application of a plurality of fluids either simultaneously or sequentially. The remotely operated ~~valves~~ valves are conventional in construction and operation and may operate responsive to electrical, electromagnetic, pneumatic, and/or hydraulic signals.

The plural component spraying systems shown in Figures 13, 14, and 15 can be used  
20 with a wide variety of nozzles, all of which are listed in U.S. Patent No. 5,922,333

which is assigned to the assignee hereof. Included are traditional atomization nozzles and electrostatic nozzles.

The plural component spraying systems of Figures 13, 14, and 15 are advantageously used to apply self-tanning (a.k.a. sunless tanning) compositions. For example, a  
5 DHA/bronzer/moisturizer mixture may comprise a first component and a tan enhancing component, which normally would destabilize the DHA component, and may comprise the second component of a plural component self-tanning composition. Examples of the tan enhancing component include penetration enhancers and materials ~~with~~ which effect the chemical binding of the DHA to skin components. By simultaneously or  
10 sequentially misting the two components, an enhanced tan is achieved without requiring the consumer to deal with a multi-component system.

In a second example, a plural component wrinkle treatment which includes solutions at different pHs, or which rapidly react with each other, is applied to the skin sequentially.

Yet another example comprises on-skin polymerization. This is used to spray apply a  
15 body barrier layer which is impervious to water, radiation, etc. In this example, the solutions which contain reactive ingredients come into contact only after being applied to the skin.

Still another example is the use of an activator and base. The two component hydrogen peroxide system which is disclosed in U.S. Patent No. 6,117,118 is advantageously applied by a plural mist-on process illustrated in Figures 13, 14, and 15 and described hereinabove in conjunction therewith. The end effect is whole-body bleaching of a sunless tan.

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Although preferred embodiments of the invention are illustrated in the Drawings and described in the Detailed Description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous modifications and rearrangements of parts and elements without departing from the spirit of the invention.